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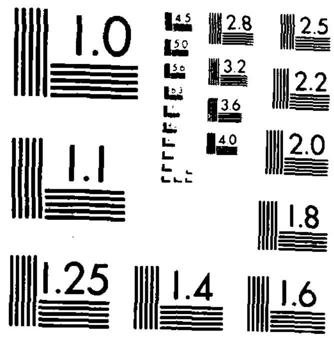
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The purpose of this investigation was to determine the effectiveness of psychophysical lifting training on maximal repetitive lifting capacity. Maximal repetitive lifting capacity was defined as the maximum box mass that could be lifted for a full hour to a height of 132 cm at a rate of 6 lifts$\cdot$min^{-1}. Eight male subjects participated in five psychophysical lifting training sessions each week for four weeks. Each day subjects were presented one empty and one heavily loaded box and asked to adjust to the maximum load they felt capable of lifting for one hour. This load was lifted at a rate of 6 lifts$\cdot$min^{-1} to a height of 132 cm for two 15 minute sessions. After four weeks of training, subjects did not select a heavier training load, exhibit a decreased training heart rate, or report a decreased training ratings of perceived exertion. The training program produced a significant increase in one hour maximal repetitive lifting capacity. The box mass selected for the maximal repetitive lifting capacity test increased significantly following training, with no concomitant change in VO_2, heart rate or RPE. It can be concluded that while psychophysical training is not a

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progressive resistive routine, a substantial increase in work output for a given energy expenditure can be expected in inexperienced lifters. These increases are attributed to neural factors and possible increases in the muscular endurance of specific muscle groups occurring with practice.

Abstract

The purpose of this investigation was to determine the effectiveness of psychophysical lifting training on maximal repetitive lifting capacity. Maximal repetitive lifting capacity was defined as the maximum box mass that could be lifted for a full hour to a height of 132 cm at a rate of 6 lifts•min^{-1}. Eight male subjects participated in five psychophysical lifting training sessions each week for four weeks. Each day subjects were presented one empty and one heavily loaded box and asked to adjust to the maximum load they felt capable of lifting for one hour. This load was lifted at a rate of 6 lifts•min^{-1} to a height of 132cm for two 15 minute sessions. After four weeks of training, subjects did not select a heavier training load, exhibit a decreased training heart rate, or report a decreased training RPE. The training program produced a significant increase in one hour maximal repetitive lifting capacity. The box mass selected for the maximal repetitive lifting capacity test increased significantly following training, with no concomitant change in $\dot{V}O_2$, heart rate or RPE. It can be concluded that while psychophysical training is not a progressive resistive routine, a substantial increase in work output for a given energy expenditure can be expected in inexperienced lifters. These increases are attributed to neural factors and possible increases in the muscular endurance of specific muscle groups occurring with practice.

Effects of psychophysical lifting training on maximal repetitive lifting capacity

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Introduction

Repetitive lifting is the most physically demanding aspect of many occupations and is often the precipitating cause of lower back injury. Research studies have been conducted to determine safe loads to reduce the lifting injury rate, but some loads cannot be reduced or the task redesigned to comply with recommendations. This is particularly true of emergency and military field work, such as lifting stretchers or heavy artillery shells. For this type of heavy lifting, careful employee screening and training are the only viable alternatives.

Pre-employment screening of individuals is costly, of questionable validity and has not always been shown to reduce injuries.[1,2] Asfour et al.[3] reported that a four week endurance and strength training program significantly increased the lifting capability of healthy young males. Lifting capability was defined as the maximum weight subjects could lift and lower once for a given height of lift. In practice, many lifting tasks involve repetitive lifting, rather than a single maximal lift. It is therefore important to study the effects of training on repetitive lifting capacity, and in particular, maximal repetitive lifting.

Military personnel are required to participate in regular physical training, but the training is not typically directed at improving lifting capacity. Civilian employees are generally not required to perform any physical training due to administrative cost and time

constraints. For tasks requiring repeated heavy lifting, a more feasible training mode may be one which can be performed as part of the initial training phase for new employees. One approach is to use a modified psychophysical methodology, in which the individual performs a job specific lifting task and regulates the load lifted. This form of training could be performed during working hours and requires no specialized equipment. It is likely to have a low injury rate, since the individual sets the exercise intensity, and can make adjustments commensurate with his own perception of discomfort. A possible disadvantage is that the load selected may be too low to provide sufficient training stimulus.

The purpose of this investigation was to examine the effectiveness of a task specific psychophysical lifting training program on maximal repetitive lifting capacity, muscular strength, muscular endurance and aerobic capacity.

Methods

Eight healthy male soldiers volunteered as subjects for this study. They were briefed, medically screened, then read and signed an informed consent statement. The means and standard deviations for their physical characteristics were as follows: age=21.6 ± 1.8 years, height=175.9 ± 10.3 cm, weight=76.3 ± 11.5 kg and percent body fat=14.1 ± 4.7%. Percent body fat was determined from the sum of four skinfold measurements

(biceps, triceps, subscapular and suprailiac) using the equations of Durnin and Womersley.(4)

The experiment took place over an eight week period, as outlined in Table I. During week 1 descriptive measures of muscular strength and endurance, aerobic capacity and anaerobic power were made. Adequate recovery time was allowed between tests. Lifting familiarization took place following data collection during week one and on the first two days of week two. Subjects lifted low mass boxes at either 15 $lifts \cdot min^{-1}$ or 6 $lifts \cdot min^{-1}$ to prepare for subsequent testing. Maximal repetitive lifting capacity was measured during the last two days of week two, with half the subjects measured each day. Subjects rested two full days prior to the one hour test. Psychophysical lifting training commenced on the first day of week three and continued (Monday through Friday) until the end of week six. Post-training reassessment of repetitive lifting capacity took place on the first two days of week seven and the box mass selected was verified during the last two days of the week. As in the pre-test, half the subjects were measured each day, with a two day rest period between the second repetitive lifting capacity determination and the verification trial.

Subjects participated in a four week psychophysical lifting training program, five days each week for 45 minutes each day. Training consisted of two 15 minute bouts of lifting separated by a 15 minute rest period. An aluminum box (46.5 cm long x 31 cm wide x 23 cm high) was lifted to the platform of a repetitive lifting ergometer.(5) The ergometer

automatically lowered the box to floor level from a platform height of 132 cm. The lifting rate was set at 6 $lift \cdot min^{-1}$ and a freestyle lifting technique was used. The subject selected his own training weight using a modified psychophysical methodology. In contrast to the conventional psychophysical method in which subjects are instructed to choose the maximum acceptable weight to be lifted for an 8 hour period,[6] subjects were instructed to select the maximum tolerable weight they felt they could continue lifting for one hour. The initial box mass was alternated within and between sessions so that the subject started with either an empty (7.8 kg) or full (60 kg) box. They were allowed to adjust the box mass before starting and at any time during the 15 minute period by adding or removing steel shot.

Maximal repetitive lifting capacity was assessed in a manner similar to lifting training. The repetitive lifting ergometer was set to a 132 cm platform height, and the subject was instructed to exercise at a rate of 6 $lifts \cdot min^{-1}$ using a freestyle lifting technique. Before exercise began, the subject adjusted the empty aluminum box to the heaviest mass they felt was tolerable and which they could continue lifting for one hour. A total of eight 30 second load adjustments were allowed. The first immediately before lifting commenced and at 5, 10, 15, 20, 30, 40 and 50 minutes into the test. One hour maximal repetitive lifting capacity was defined as the final box mass (kg) selected by the subject.

Expired gases were collected through a Daniels valve into vinyl Douglas Bags during the last two minutes of repetitive lifting. Gas

samples were analyzed for fractional concentrations using Beckman LB-2 CO_2 and Applied Electrochemistry S-3A O_2 analyzers. Gas volumes were measured using a Collins chain compensated Tissot spirometer, and corrected to standard temperature and pressure of dry gas (STPD) for calculating oxygen uptake ($\dot{V}O_2$) and to body temperature and pressure of saturated gas (BTPS) for determining minute ventilation ($\dot{V}_E$). Carbon dioxide output ($\dot{V}CO_2$) and the respiratory exchange ratio (R) were also calculated. Disposable electrodes were placed in a CM5 configuration and connected via wire leads to an electrocardiograph which was monitored continuously. The heart rate reported was measured over the last 30 seconds of exercise. Upon completion of the one hour lifting task, a rating of perceived exertion (RPE) was obtained.[7]

Repetitive lifting power output was calculated using the following equation, which takes into account the work in raising both the box and the lifter's body.

$$P = F(W_B T_B + W_L T_L)/60.0$$

where:

P = power (W)

F = lift frequency ($\text{lifts}\cdot\text{min}^{-1}$)

W_B = box mass (newtons)

T_B = vertical box travel (meters)

W_L = lifter's body mass (newtons)

T_L = vertical travel of lifter's center of mass (meters)

Subjects were filmed during the maximal repetitive lifting capacity test to calculate the movement of the lifter's center of mass. A more complete description of this calculation has been published elsewhere.[8] The efficiency of repetitive lifting was defined as power output converted from watts to kcal•min^{-1} using a conversion factor of .0143, divided by absolute oxygen uptake in kcal•min^{-1} using a conversion factor of 4.9.

Maximal oxygen uptake ($\dot{V}O_2max$) was determined for uphill treadmill running and for repetitive lifting exercise. Discontinuous protocols were used for both determinations. Expired gases and volumes were analyzed in the same way described earlier, except that the gases were collected during the final minute of exercise, and heart rate during the final 30 seconds. The treadmill test began with a six minute warm up at 6 mph, followed by three to five additional exercise bouts of increasing intensity separated by 10 minute rest periods. The heart rate at the end of the warm up was used to determine speed and the intensity was controlled by increasing the treadmill grade.[9] Treadmill $\dot{V}O_2max$ was defined as less than 0.15 l•min^{-1} increase in oxygen uptake with a 2.5% increase in grade.

The repetitive lifting $\dot{V}O_2max$ test was conducted on the repetitive lifting device. The platform height was 132 cm and the lifting rate was 15 lifts•min^{-1}. A three minute warm up with a 15 kg box was followed by three to five additional lifting bouts with increased box mass separated by 10 minute rest periods. Repetitive lifting $\dot{V}O_2max$ was defined as a

plateau in $\dot{V}O_2$ with an increase in box mass of 2 kg, or as the highest oxygen uptake obtained before the subject was unable to continue.[8] Each subject practiced lifting for several sessions to allow for familiarization with the apparatus and technique development.

Isometric handgrip was measured in a seated position with the forearm resting on a table. The handgrip device was adjusted to produce a 150° angle at the third metacarpalphalangeal joint and 110° at the proximal interphalangeal joint of the third finger.[10] Back extensor strength was measured in a standing position with a strap placed around the subjects shoulders and attached at chest level to an electronic load cell.[11] An indicator provided a digital readout for both isometric measurements. The mean of the highest two of three exertions was recorded as the isometric strength of the respective muscle group.

Isoinertial lifting strength was determined using two different methods. With the first, the subject repeatedly lifted the handles of a weight stack machine from a starting handle height of 40 cm to a final handle height of 152 cm.[12] The mass lifted was increased by 4.5 kg with each lift, until the subject failed at a lifting attempt. A bent knee straight back lifting technique was required. The mass range of the weight stack was 20 - 91 kg. The last successful load lifted prior to failure was accepted as the one repetition maximum (1RM) machine lift.

A second assessment of isoinertial lifting strength was made using the repetitive lifting ergometer with the platform locked at 132 cm and a box similar to that used during the repetitive lifting capacity test.

Following a warm up, mass was added to the box with each successful lift in increments between 1 and 11 kg. One minute rest was allowed between lifts, and an attempt was made to reach the subject's maximum within 5 to 7 lifts. The last successful weight lifted prior to subject failure was accepted as the 1RM box lift. Experienced test administrators stood on either side of the subject, and assisted in lowering the box during the final, incomplete lift.[8]

Isokinetic strength and endurance for left elbow flexion and right knee extension were determined using a Cybex II isokinetic dynamometer. Strength was determined at angular velocities of 30 and 180 $^{\circ}\cdot sec^{-1}$.[10,13] Three contractions were performed at each speed with one minute rest between contractions. The mean of the two highest of the three contractions was selected as the final score. In order to test isokinetic endurance fifty contractions were performed at 180 $^{\circ}\cdot sec^{-1}$.[14] Fifty knee extensions were completed in 60 sec, but due to the greater range of motion 50 maximal elbow flexions took 80-85 seconds to complete. The two calculations made to examine isokinetic endurance were percent torque decrease (PTD) which was the percent decrease in peak torque between the highest three of the first and last four contractions and mean peak torque (MPT) which was the mean of all 50 contractions.[15]

Paired t-tests were used to determine the significance of changes observed in the descriptive measures pre to post lifting training. Repeated measures analysis of variance (ANOV) was used to compare the

three maximal repetitive lifting capacity tests. A preset alpha level of .05 was selected to represent a significant difference unless otherwise noted in the text.

Results

The final box mass selected, final RPE and final heart rate over 20 days of repetitive lifting training are illustrated in Figures 1 and 2. There was no significant difference in the training load selected due to the initial box mass (heavy or empty), nor was there a difference between trials one and two. For this reason, the two trials were averaged for each subject within days. A repeated measures ANOV revealed no significant change in training load, RPE or heart rate over 20 days of psychophysical training. The mean box mass selected for training was 51% of the pre-training 1RM box lift, and approximately equal to the pre-training maximal repetitive lifting capacity. Training heart rates averaged 78% (range 73-83%) of heart rate at repetitive lifting $\dot{V}O_2max$. Although not a significant change, Figures 1 and 2 do seem to show a tendency for heart rate to decrease, while final box mass tended to increase.

The aerobic capacity for treadmill running and repetitive lifting did not change significantly pre to post lifting training, based on the preset .05 level of significance. However the absolute $\dot{V}O_2max$ for repetitive lifting was different pre to post training at the $p<.07$ level

of significance. Results of the two tests of aerobic capacity pre and post training are listed in Table II. Repetitive lifting $\dot{V}O_2max$ was approximately 20% lower than treadmill $\dot{V}O_2max$ before and after lifting training. Heart rate at $\dot{V}O_2max$ was significantly lower post training for both exercise modes. Although repetitive lifting $\dot{V}O_2max$ was only 6% greater pre to post training, the box mass required to reach $\dot{V}O_2max$ was 24% greater ($p<.01$) after lifting training. This increase in box mass was accompanied by 20% increases in power output and total work performed.

The strength and endurance measurements made before and after lifting training are listed in Table III. Isometric trunk strength was significantly increased 11.7% following lifting training, while isometric handgrip did not change. Of the two isoinertial lifting tests, only the task specific 1RM box lift was significantly greater (4.3 kg) following training. Isokinetic leg extension strength at 180 $°\cdot sec^{-1}$ was increased 13.4% after lifting training, but this was not reflected in any other isokinetic strength measurement. Isokinetic leg extension endurance measured as MPT was significantly greater following lifting training, however there was no significant difference in PTD. Isokinetic arm flexion endurance was not significantly changed following training.

Values obtained at the end of the one hour maximal repetitive lifting capacity tests are presented in Table IV. There was a 26% increase in maximal repetitive lifting capacity pre to post training. Subjects selected a load equal to 50.3% of their pre-training 1RM box

lift during trial one. The post training load selected represented 59.2% of post training 1RM box lift. Since lifting height and rate did not change from pre to post training an increase in box mass selected produced a significant 11% increase in both power output and work done. There were no significant differences in the cardiorespiratory measures, RPE or efficiency at the end of the one hour lifting task from pre to post training. The maximal repetitive lifting capacity test intensity was 68.5% and 67.2% of repetitive lifting $\dot{V}O_2max$ before and after training, respectively.

The third maximal repetitive lifting capacity trial was performed to ensure that subjects were capable of completing a full hour of lifting the final box mass selected during trial 2. Subjects were not permitted to make any changes in the box mass during trial 3. There were no significant differences found in the final values for maximal repetitive lifting capacity from the post training trial to the verification trial. All subjects were able to lift the final load selected during trial 2 for a full hour during trial 3. The final load on trial 2 is not exactly the same as trial 3 due to one subject who increased the box mass from 33.6 kg to 35.3 kg at the 30 minute adjustment. He was almost unable to continue at minute 50, when he decreased the box mass to 28.7 kg for the last 10 minutes of lifting. Based on the subject's physiological responses, it appeared that the final box mass adjustment was an overcompensation. During the verification trial, this subject was assigned a 33.6 kg box and was able to complete the full hour of lifting.

Discussion

These data indicate that psychophysical lifting training is an effective way of improving job performance in inexperienced lifters. Subjects were able to lift a heavier box mass during the $\dot{V}O_2max$ test, the 1RM box lift and most importantly for one hour during the maximal repetitive lifting capacity test. Lifting training did not increase the general physical fitness of the subjects.

Psychophysical lifting training at 73-83% of maximum heart rate for repetitive lifting was not effective in eliciting a cardiovascular training effect. The increase in maximal oxygen uptake for repetitive lifting following training did not quite meet the 5% level of significance. This is in accord with most studies of progressive resistance training which show little or no increases in aerobic capacity.[16] The fact that subjects did not select a significantly heavier box over the four week training period is in keeping with their training heart rate and RPE which did not change. The weight selected was probably an accurate representation of what they felt capable of doing for a one hour period, rather than a lack of motivation to perform lifting exercise. Utilizing heart rate as a measure of training intensity it may be concluded that training at 73-83% of heart rate at repetitive lifting $\dot{V}O_2max$ was not a sufficient stimulus to produce a cardiovascular training effect in these subjects.

Psychophysical lifting training produced a significant increase in physical work capacity during the maximal repetitive lifting capacity test, as evidenced by an increased box mass lifted. This was true in both an absolute sense and relative to 1RM box lift. Maximal repetitive lifting capacity relative to 1RM box lift was increased pre to post training (50.3 vs 59.2%), despite the fact that 1RM box lift was significantly greater post training. The increased box mass was not accompanied by a significantly increased energy cost and was not perceived to be more difficult to lift. The increase in lifting capacity appeared to be highly task specific, since the 1RM box lift increased while the 1RM machine lift did not. The 1RM box lift was measured using similar equipment and procedures as used during training, while the 1RM machine lift required a different lifting technique and different equipment.

The percent increase in maximal repetitive lifting capacity and box mass during repetitive lifting $\dot{V}O_2max$ were 26% and 24%, respectively, while the increase in repetitive lifting $\dot{V}O_2max$ and 1RM box lift were only about 7%. It appears that the dramatic increase in lifting capacity cannot be completely explained by increases in either 1RM box lift or aerobic capacity. The time course of muscle strength gains due to progressive resistance training has been shown to be dependent upon an initially dominant neural component (first two weeks), which is gradually replaced by a hypertrophic component (weeks 3 to 5).[17] It is likely that the neural component was largely responsible for the

improved maximal repetitive lifting capacity following psychophysical training.

Isometric trunk extension strength was 10% greater following lifting training. These soldiers were not experienced lifters prior to the study, and psychophysical lifting training may have provided sufficient stimulus to increase back extensor strength. The increase in isokinetic leg extension strength at 180 $^\circ \cdot sec^{-1}$, with no change at $30^\circ \cdot sec^{-1}$ is more difficult to explain. It may be a speed specific training effect such as an increased ability to recruit fast contracting motor units. Since psychophysical training did not involve progressive resistance, it is not surprising that general increases in muscular strength and endurance measures were not observed. It may be that only those muscle groups without an adequate "strength reserve" for repetitive lifting were stressed sufficiently to show strength increases. The significant increase in isokinetic leg extension MPT indicates that muscular endurance is also affected by psychophysical lifting training. Perhaps muscular endurance is more important in maximal effort repetitive lifting than absolute muscle strength.

Psychophysical training allowed the subjects to perform more work over one hour and at maximal aerobic capacity without increasing the energy cost. It resulted in an increased 1RM box lift without increasing 1RM machine lift and increased isokinetic leg extension MPT with no change in arm flexion endurance. Psychophysical training is more likely to produce highly skilled lifters, than individuals who are stronger and

more physically fit. Despite increases in 1RM lift capacity and $\dot{V}O_2max$ of less than 10%, the one hour maximal repetitive lifting capacity was increased 26% following four weeks of training. If the goal in instituting a training program is to improve job performance, task specific psychophysical training of this type will improve the maximal repetitive lifting capacity of inexperienced lifters. The effects of this type of training on experienced lifters cannot be extrapolated from these data. The maximal repetitive lifting capacity test could be used as a pre-employment screening task as well. Employees might be expected to perform 15-20% more work after several weeks on the job than they were able to complete on the screening test. Appropriate entrance level lifting capacities could be established based on lifting experience and initial ability.

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TABLE I

Experimental Design

Week	Measurements
1	Descriptive Measures:
	Aerobic capacity-repetitive lifting and treadmill running maximal oxygen uptake
	Muscular strength and endurance
	Isometric handgrip strength
	Isoinertial lifting strength (machine and box)
	Isokinetic leg extension and arm flexion strength
	Isokinetic endurance
	Lifting familiarization
2	Lifting familiarization
	Maximal repetitive lifting capacity (pre-test)
3-6	Psychophysical lifting training
7	Maximal repetitive lifting capacity (post-test and verification)
8	Post training descriptive measures (see week 1)

TABLE II

Aerobic Capacity for Treadmill Running and Repetitive Lifting Before and After Lifting Training (Mean and SD)

	Treadmill		Repetitive Lifting	
	Pre	Post	Pre	Post
$\dot{V}O_2max$ ($l \cdot min^{-1}$)	3.94	4.07	3.11	3.29
	.50	.48	.45	.36
($ml \cdot kg\ BW \cdot min^{-1}$)	52.1	53.5	41.0	42.8
	5.9	4.7	3.7	4.3
Heart Rate (bpm)	196.0	190.5[1]	188.1	181.1[1]
	7.6	6.4	15.2	9.5
$\dot{V}_E$ ($l \cdot min^{-1}$)	146.0	155.8	111.8	128.7
	22.8	26.6	17.4	34.3
Box Mass (kg)	NA	NA	25.0	30.9[1]
			3.0	3.9

[1]Significant difference pre to post training ($p<.05$).

NA=Not Applicable to treadmill exercise.

TABLE III

Strength and Endurance Measured Before and After Lifting Training

	Pre-Training Mean ± SD	Post Training Mean ± SD
Trunk Extension (kg)	85.1 ± 17.3	95.0 ±13.5[1]
Handgrip	59.3 ± 10.3	61.9 ±12.5
Machine Lift (kg)	72.0 ± 10.7	73.2 ±13.2
Box Lift (kg)	63.8 ± 13.8	68.1 ±13.5[1]
Arm Flexion $30^{0} \bullet sec^{-1}$	57.1 ± 8.4	58.6 ±12.8
$180^{0} \bullet sec^{-1}$	46.4 ± 7.3	46.3 ±14.4
Peak Torque Decrease	61.0 ± 4.3	57.9 ± 7.9
Leg Extension $30^{0} \bullet sec^{-1}$	203.4 ± 51.0	216.6 ±64.1
$180^{0} \bullet sec^{-1}$	132.1 ± 30.3	149.8 ±37.4[1]
Peak Torque Decrease	64.7 ± 12.8	61.2 ±10.0

[1] Significant change pre to post training at the .05 level.

TABLE IV

Effects of a One Hour Maximal Repetitive Lifting Capacity Test Before and After Lifting T

(Final Mean ± SD, n=8)

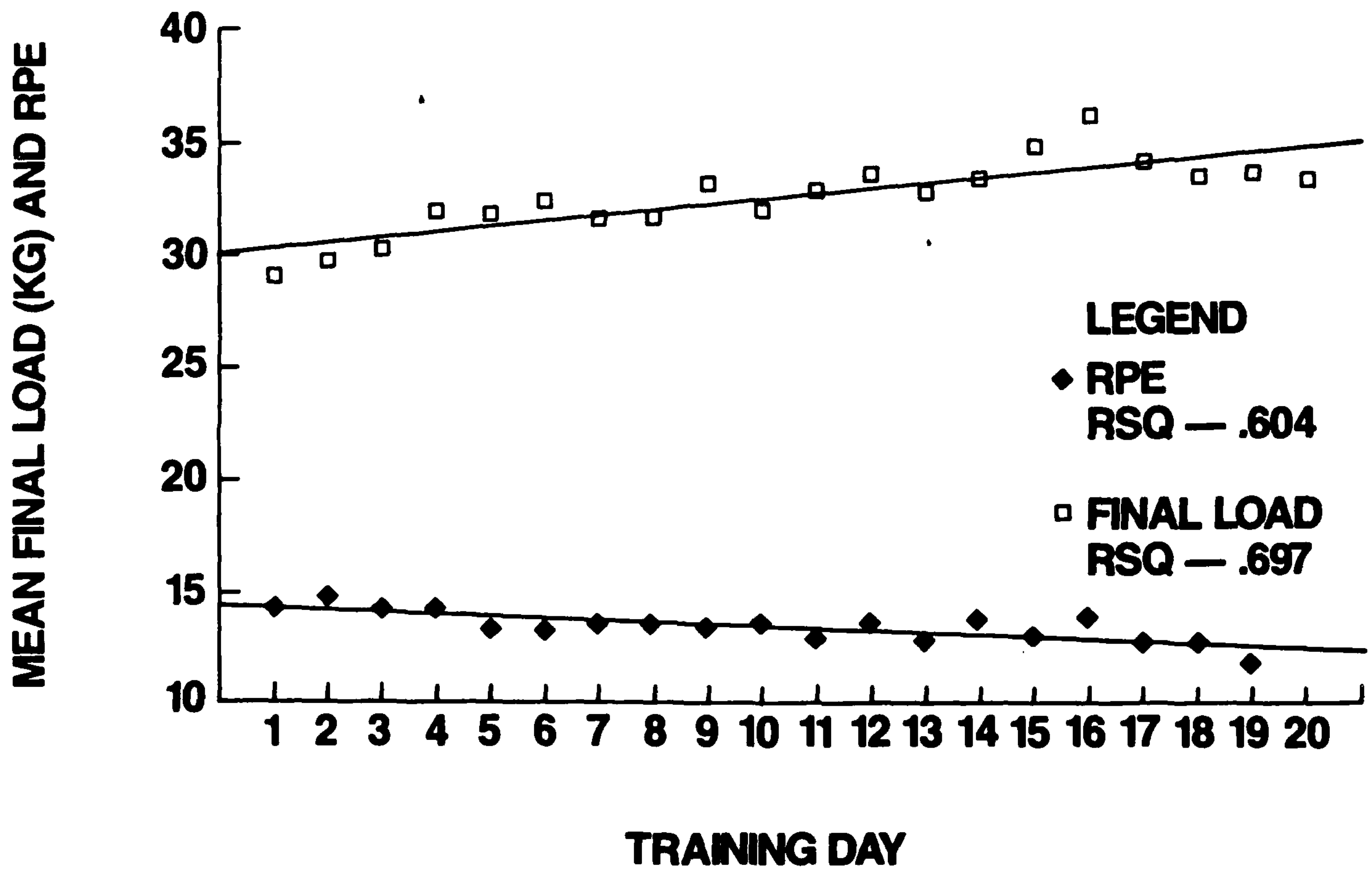
	Pre-Training	Post Training	Verification
Box Mass (kg)	31.5 ± 6.4	39.7 ± 8.5[1]	40.7 ± 7.9
$\dot{V}O_2$ ($l \bullet min^{-1}$)	2.03 ± 0.42	2.17 ± 0.23	2.21 ± 0.26
($ml \bullet kg\ BW \bullet min^{-1}$)	26.5 ± 3.1	28.5 ± 2.9	29.0 ± 3.2
$\dot{V}_E$ ($l \bullet min^{-1}$)	62.7 ± 19.8	69.5 ± 10.2	68.0 ± 10.5
Heart Rate (bpm)	172.5 ± 12.1	170.4 ± 13.9	169.4 ± 15.6
R	.96 ± 0.02	.97 ± 0.04	.95 ± 0.04
RPE	18.0 ± 1.6	17.2 ± 2.4	17.0 ± 2.1
Work (kJ)[2]	247.1 ± 29.7	277.6 ± 30.4[1]	294.6 ± 38.2
Power (W)	71.7 ± 9.8	80.0 ± 11.3[1]	81.4 ± 11.2
Efficiency (%)	10.5 ± 1.1	10.8 ± 1.2	10.7 ± 0.9
$\dot{V}CO_2$ ($l \bullet min^{-1}$)	25.5 ± 3.2	27.8 ± 2.9	27.6 ± 3.5

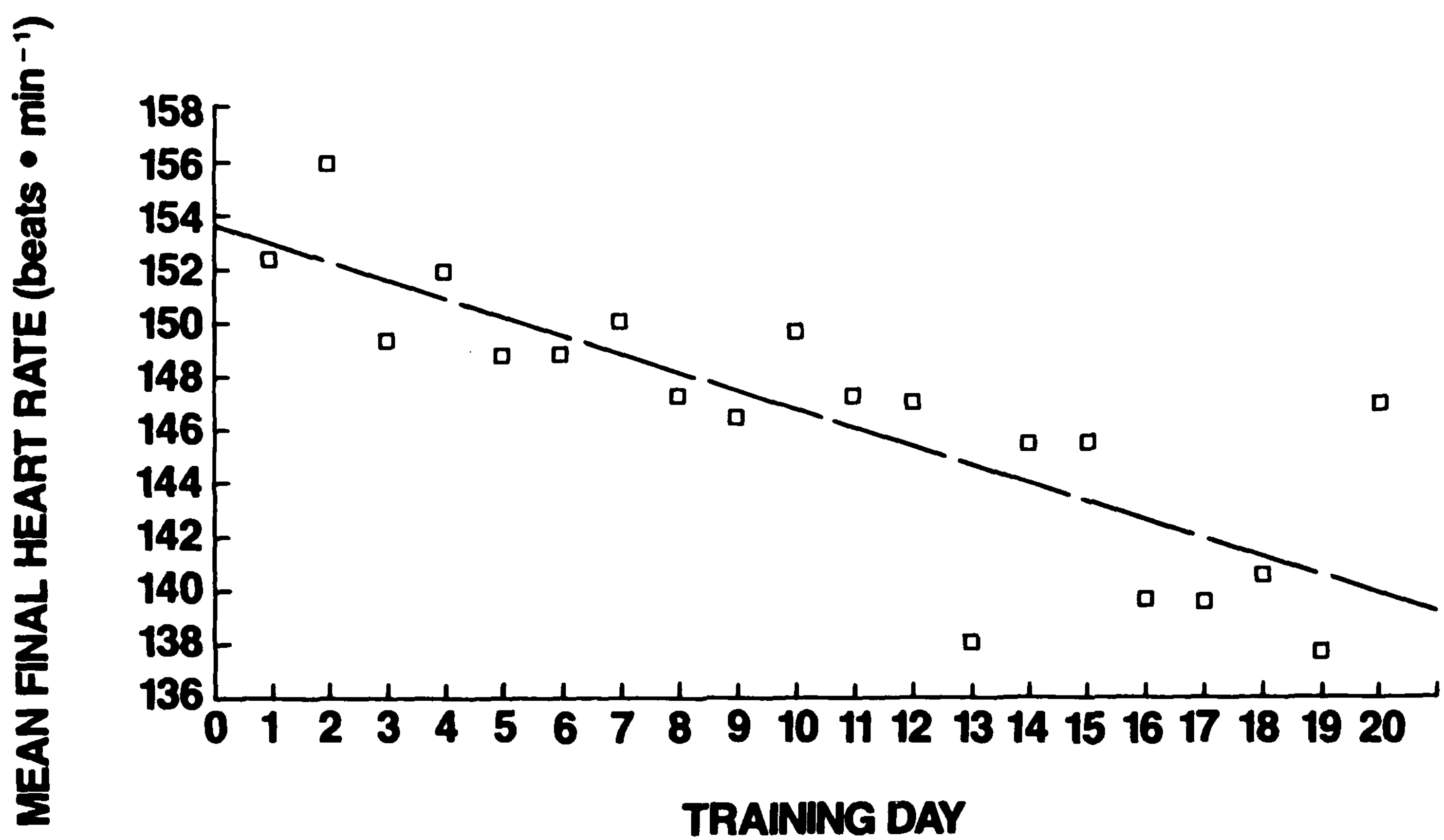
[1] Significant difference pre to post training ($p<.01$).

[2] For one hour of lifting.

Figure 1--Final box mass selected and RPE reported over 20 days of psychophysical lifting training. Each point represents the mean of two trials for eight subjects.

Figure 2--Mean final heart rate measured at the end of two 15 minute bouts of psychophysical lifting training across 20 days. (n=8)


MEAN FINAL LOAD (KG) AND RPE
40
35
30
25
20
15
10
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
TRAINING DAY
LEGEND
RPE
RSQ — .604
FINAL LOAD
RSQ — .697


MEAN FINAL HEART RATE (beats • min⁻¹)
158
156
154
152
150
148
146
144
142
140
138
136
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
TRAINING DAY

END
DATE
FILMED
6-88
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